News Releases

Meet NAMRU-SA's Research Dentists –Focused on Innovation to Support Warfighter Readiness

Released: 8/18/2017

From Naval Medical Research Unit - San Antonio Public Affairs

Lt. Noel Dickens, DMD (left), Principal Investigator and Department Head of Biomaterials and Epidemiology, Lt. Cmdr. Jeffery Hoyle, DDS (center, left), Principal Investigator and Department Head of Maxillofacial Injury and Disease, Capt. Jonathan Stahl, PhD, DDS (center, right), Principal Investigator in the Biomaterials and Epidemiology Department, Lt. Cmdr. Nicholas Hamlin, PhD, DDS (right), Principal Investigator and Department Head of Environmental Surveillance. (Photo courtesy of NAMRU-SA Public Affairs)

SAN ANTONIO – Research dentists in the Craniofacial Health and Restorative Medicine Directorate (CH&RM) at Naval Medical Research Unit - San Antonio (NAMRU-SA), continue a strong and proud tradition of dedicating their service to ensure dental readiness and heath for service members around the globe by being at the forefront of dental research, science, and innovation.

"NAMRU-SA's research dentists are ultimately aimed at having a positive impact on the health and readiness of Sailors and Marines through treatment, detection, and prevention of craniofacial disease and injuries," said Dr. John Simecek, Director, CH&RM.

These research dentists conduct a variety of projects to better provide for the warfighter. "Navy dentists have a long tradition of utilizing research to improve the health of service members dating back to 1947 when the first dental research facility was established at Great Lakes," said Capt. Jonathan Stahl, Biomedical Research Dentist and Principal Investigator, Biomaterials and Epidemiology Department.

News Releases

Tackling Common Problems: NASA Scientists and NSMRL Researchers

Summer Interns Support Unique Research at NAMRU – Dayton

R&D Chronicles: Dr. Krueger and the Story of the First NAMRU

Navy Undersea Medical Officer and Anesthesiologist Slated for Research at Naval Medical Research Center

Surface Warfare Officer Selected NAMRU-Dayton for Graduate Internship

Meet NAMRU-SA's Research Dentists – Focused on Innovation to Support Warfighter Readiness

Keeping Cool with Science

New Commanding Officer to Continue Research Excellence at NHRC

NAMRU-Dayton hosts Aerospace Medicine Research Alignment and Collaboration

Navy Medical Research Lab in Cambodia Receives Award for Supporting Public Health

Peruvian Navy Surgeon General and Other Distinguished Guests Visit Naval Medical Research Center

Military Sealift Deputy Commander Visits Navy Lab in Dayton

Two Naval Medical Research Center Corpsmen Selected for Medical Degree Prepatory Program

NMRC Summer Interns Arrive, All Ready to Research

NAMRU-SA Researchers Working on Laser Therapy Project to Improve Treatment of Multi-Drug Resistant Wound Infections

R&D Chronicles: Remembering NAMRU-5, the Navy's Medical Laboratory in Ethiopia, 1965-1977

Defense Health Agency to Assume Oversight of DoD HIV/AIDS Prevention

Program

NAMRU-SA Research Dentist Competes for IRONMAN "All World Athlete" Status

Navy Core Values and Grit in Action – A Trek to Mt. Everest Base Camp

NMRC Participates in Second Biennial Department of Defense Lab Day

Wound Dressings and Treatment for Specific Bacterial Infections:

"Currently, wound dressings used on the battlefield are traditional bandages to help control hemorrhage but do not actively help in the healing process," said Stahl.

Stahl and his team are looking into nano-fibrous wound dressings with bioactive factors such as growth factors, antibiotics and other agents to speed up healing and reduce facial scar formation. Ideal management of skin wounds is predicated on the minimization of infection at the site of injury.

Engineers and scientists built an electrospinning device to make dressings using nanofiber technology. Biologically compatible natural and synthetic polymers are dissolved into a solvent along with bioactive agents and spun into a wound dressing using electrical forces. The electrospun fiber was successful in inhibiting both growth and attachment of *Staphylococcus aureus* bacteria, which is the bacterium that causes staph infections.

"Development of the active antibacterial scaffold presented in this study is critical in providing a platform for a new generation of antimicrobial wound dressings," said Stahl.

Ongoing projects also include investigations for rapid detection of waterborne pathogens and evaluation of antimicrobial peptides to eliminate microorganisms of military relevance caused by members of the ESKAPE group of pathogens: *Enteroccous, Staphyloccocus, Klebsiella, Acinetobacter, Pseudomonas, Escherichia.*

Reducing Dental Emergences and Assessing Caries Risk:

Lt. Noel Dickens, Principal Investigator and Department Head, Biomaterials and Epidemiology Department, is leading an investigation into dental emergencies and the effect they can have on the overall fighting condition of the warfighter. While rarely life-threatening, dental emergencies can either hinder or prevent a service member from completing assigned tasks, which has the potential to impact a unit's operational or fighting capabilities.

"In order to better understand the types of dental emergencies afflicting service members we continually analyze dental emergency surveillance data," said Dickens.

He is also studying the effect of dental protocols on the risk of developing new dental pathology and the reduction of the risk for caries, known commonly as cavities. Patients assessed as high or moderate risk for caries development receive preventative treatments, as outlined by an Oral Disease Risk Management Protocol utilized in Navy Dentistry. The current scientific approach by the research team is to assess the one year effect of these treatments on a service member's overall caries risk.

Researchers are also responsible for analyzing utilization trends of new dental technology in the Navy. Acceptance of computer-aided design/milling (CAD/CAM) technology in the Navy represents a shift in the dental treatment paradigm. This technology delivers significant benefits to both patients and providers.

"Our research aims to assess the effect of utilizing CAD/CAM technology in the military and its effect on the utilization of traditional dental treatment techniques," said Dickens.

Using Nanoparticles for Environmental Biomedical Applications:

Lt. Cmdr. Jeffery Hoyle, Principal Investigator and Department Head, Maxillofacial Injury and Disease Department and his team are testing and evaluating a filtration technology to efficiently, conveniently, and inexpensively capture dental mercury amalgam waste. This is especially critical for the Navy, as recent federal laws from the Environmental Protection Agency, in addition to many local regulations set by publicly owned treatment works, set strict standards for the amount of mercury that can be released into the wastewater coming from dental treatment facilities (DTFs).

Another project involves the natural biopolymer melanin to silica nanoparticles to optimize its ability to bind to heavy metal environmental contaminants such as mercury and lead. The purpose is to construct and characterize an efficient and biocompatible chemical unit for removing heavy metal ions from solutions such as industrial waste streams. If successful, melanin nanoparticles may be incorporated into novel filtration materials or serve as a versatile functional unit for diverse environmental and biomedical applications.

“Innovations like these are needed to enable the Department of Defense to meet local and federal environmental standards and will elevate the Navy's status as a leading environmental steward,” said Hoyle.

Novel Technology for Phage Research, and Bone Grafting:

Lt. Cmdr. Nicholas Hamlin, Department Head and Principal Investigator, Environmental Surveillance Department, is doing research into a broad spectrum of topics, including the development of genetically modified bacteriophage to selectively target and control dental related diseases caused by bacteria and plaque, as well as the development of a novel, inexpensive, and easy to use bone grafting material to preserve bone after tooth extraction to better facilitate the replacement of missing teeth using dental implants.

Dental disease is a significant burden on warfighter readiness. The control of dental caries early on can greatly reduce the likelihood of a dental emergency due to chronic disease, further preventing reduction in readiness. Using bacteriophage and genetic engineering approaches, researchers are developing a novel approach to treating caries-causing bacteria specifically, as well as disrupting the biofilm (plaque) in which they reside.

“Currently, there is no existing ‘dental caries vaccine,’ and often times sticking to a high quality oral hygiene regimen is difficult for service members in austere environments, so the need for new breakthroughs in how to control and reduce the rate of dental caries in our fighting forces is critical,” said Hamlin.

Due to the high-tempo of military operations, often definitive tooth replacement with a dental implant cannot be provided after the loss of a tooth. Instead, the bony area of the jaw where a tooth has been removed must be saved in order to facilitate the placement of an implant at a later time. It is critical that the bone be preserved using grafting materials to adequately maintain the morphology of the jaw and will be replaced over time with the patient’s natural bone.

To address this problem, researchers are working on projects using a material synthesis technique called electrospinning. This technique allows for the creation of polymer materials with controlled 3-dimensional architecture to better mimic the architecture of natural bone. This

approach may be more cost effective and produce a material easier for the general dentist to manipulate surgically as a bone/ridge preservation material following tooth extraction.

“This type of material advancement will enhance the ability of active duty dentists to provide top quality care to their patients, expanding their tool kit and skill set, and rapidly restores the service member to full form, function, and esthetics,” said Hamlin.

The Navy Dental Corps celebrates their 105th birthday, August 22.

NAMRU-SA’s mission is to conduct medical, craniofacial, and biomedical research, which focuses on ways to enhance the health, safety, performance, and operational readiness of Navy and Marine Corps personnel and addresses their emergent medical and oral/facial problems in routine and combat operations.